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BOTANICAL GAZETTE

SEPTEMBER, 1892.

Flowers and insects. IX.

CHARLES ROBERTSON.

HYDRANGEA ARBORESCENS L.[1]—The stems rise from one to several feet high and bear flat-topped compound cymes measuring seven to ten centimeters across. Each cyme is commonly surrounded by a few large sterile flowers which render it much more conspicuous. These sterile flowers are remarkably persistent, retaining their form throughout the winter, though they lose their color.

The entire fertile flower with its pedicel is white. The petals are small and soon fall. The stamens, which are commonly ten, with their large anthers, are the most conspicuous part of the flower. When dehiscent they far overtop the stigmas. Nectar is secreted on the base of the styles, though pollen is the chief attraction.

The flowers are homogamous, but are visited by so many bees and flies that frequent cross-pollination is inevitable. Insects may also effect self-pollination, or spontaneous self-pollination may occur by the pollen falling upon the stigmas.

The plants are common on creek banks and were observed in bloom from June 24th to July 23rd. The following list of visitors was observed June 27th and 30th:

Hymenoptera—*Apidæ:* (1) Bombus separatus Cr. ☿, c. p., ab.; (2) B. americanorum F. ♀, c. p,; (3) Ceratina dupla Say ♀, s. and c. p.; (4) Heriades carinatum Cr. ♀, c. p.; *Andrenidæ:* (5) Augochlora labrosa Say ♀, s. and c. p.; (6) Halictus pectoralis Sm. ♂♀, s. and c. p.; (7) H. similis Sm. ♀, s. and c. p.; (8) H. truncatus Rob. (MS.) ♀, s. and c. p.; (9) H. fasciatus Nyl. ♀, c. p.; (10) H. confusus Sm. ♀, s. and c. p., ab.; (11) H. stultus Cr. ♀, s. and c. p., ab.; (12) Prosopis affinis Sm. ♂♀, s. and f. p., ab.; *Crabronidæ:* (13) Crabro interruptus Lep., s.

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[1] See Meehan: Contributions to the life histories of plants, No. II, Proc. Acad. Nat. Sci., Phil., 1888.

Diptera—*Empidæ:* (14) Empis clausa Rob. (MS.) s., ab.; *Conopidæ:* (15) Oncomyia loraria Lw., s., freq.; (16) Stylogaster biannulata Say, s.; *Syrphidæ:* (17) Paragus tibialis Fll., s. and f. p.; (18) Syrphus americanus Wd., s. and f. p.; (19) Allograpta obliqua Say, s. and f. p.; (20) Mesograpta geminata Say, s. and f. p.; (21) Sphaerophoria cylindrica Say, s. and f. p.; (22) Eristalis tenax L., s.; (23) Syritta pipiens L., s. and f. p.; *Tachinidæ:* (24) Jurinia apicifera Wlk., s.; *Muscidæ:* (25) Graphomyia sp., s.; (26) Musca domestica L., s.; (27) Lucilia cornicina F., s.

Coleoptera—*Cerambycidæ:* (28) Euderces picipes F., s. and f. p.; (29) Typocerus velutinus Oliv., s. and f. p.; *Mordellidæ:* (30) Mordella marginata Melsh., s., ab.; (31) Mordellistena sp., s., ab.; (32) M. ornata Melsh.

Lepidoptera—*Hesperidæ:* (33) Eudamus tityrus F., s.; *Pyromorphidae:* (34) Harrisina americana Harr., s. (determined by Prof. G. H. French).

PHILADELPHUS GRANDIFLORUS Willd.[2]—This plant occurs in my neighborhood only in cultivation. I have found it visited very abundantly by *Heriades philadelphi* Rob. ♂♀.

RIBES GRACILE Michx.—The Missouri gooseberry is common in woods, blooming from April 15th to May 3d. The bushes are sometimes collected in large clumps, the flowers being abundant enough to fully repay the attention of insects.

The greenish flowers grow in axillary clusters of two or three. The pendulous position and the characters of the flower indicate an adaptation to bees. The calyx tube is two or three mm. long. The oblong lobes, which measure six or seven mm. in length, are strongly reflexed. With the petals they form footholds for the bees to cling to, and with their purplish bases, are the most conspicuous parts of the flower. The five stamens are exserted 12 mm. or more beyond the calyx-tube, and are closely approximated. Five pinkish petals about 2 mm. long are pressed against the filaments, closing as far as they go the intervals between them.

The flowers are proterandrous. When receptive, the stigma surpasses the anthers a little. The anthers sometimes retain pollen after the stigma becomes receptive, but self-pollination is hardly possible, unless it is brought about by insect aid. Everything points to cross-pollination between separate flowers.

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[2] On P. coronarius see Müller: Fertilization of Flowers, 248.

The nectar is secreted by an epigynous disk and is held in place by the abundant hairs on the base of the style and on the wall of the calyx-tube. To reach it bees must insert their proboscides between the filaments beyond the tips of the petals. For this purpose a proboscis at least 4 mm. long seems to be needed.

The flowers are especially adapted to bumblebee females, the only sex of Bombus flying while the flowers are in bloom. These bees are the only ones which, while sucking, invariably touch the anthers and stigmas. They cling to the petals and sepals, and the anthers and stigmas strike them about the base of the ventral surface of the abdomen. Of these the following were noted visiting the flowers for nectar:

(1) Bombus separatus Cr. ♀; (2) B. vagans Sm. ♀; (3) B. virginicus Oliv. ♀, ab.; (4) B. americanorum F. ♀, very ab.

Besides bumblebees there occur as frequent visitors a number of species of bees which insert their proboscides between the filaments and are able to reach the nectar, but are so small that they never, or rarely, touch the anthers and stigmas, and so are to be regarded as mere intruders. Such are:

Apidæ: (1) Apis mellifica L. ☿, s. and c. p., ab.; (2) Osmia albiventris Cr. ♂, s.; (3) O. lignaria Say ♂, s.; (4) Nomada luteola Lep. ♂♀, s.; *Andrenidæ:* (5) Agapostemon radiatus Say ♀, s.; (6) Augochlora pura Say ♀, s.; (7) A. lucidula Sm. ♀, s.; (8) Andrena sayi Rob. ♂♀, s., ab.; (9) A. pruni Rob. ♂♀, s.; (10) A. rugosa Rob. ♂, s.; (11) Halictus gracilis Rob. ♀, f. p., ab.; (12) H. coriaceus Sm. ♀, s.; (13) H. lerouxii Lep. ♀, s. and f. p.; (14) H. cressonii Rob. ♀; (15) H. zephyrus Sm. ♀; (16) H. imitatus Sm. ♀; (17) H. stultus Cr. ♀; (18) Colletes inaequalis Say ♂♀, s.

Diptera—*Empidæ:* (19) Empis sp., s.

The visitors were observed on nine days between April 18th and 29th.

LUDWIGIA ALTERNIFOLIA L.—The yellow flowers are rather conspicuous. Honey collects in round drops in four pits on the sides of the ovary between the bases of the filaments. The pits are slightly protected above by a fringe of hairs. Some of the anthers dehisce when fairly in contact with the stigma, but much of the stigma remains clear, and so can receive pollen brought by insects. *Bombus americanorum* F. ☿, was seen visiting the flowers for nectar, and *Halictus stultus* Cr. ♀, visiting them for pollen. The flowers were seen in bloom from July 19th to Aug. 10th.

LUDWIGIA POLYCARPA S. & P.—The flowers are wholly devoid of entomophilous characters. The petals are wanting, and there is no nectar. The four stamens bend inwards, bringing the anthers in contact with the stigma. Spontaneous self-pollination is therefore a regular occurrence.

ŒNOTHERA BIENNIS L.[3]—The following list was observed on Aug. 26th and 29th:

Apidæ: (1) Bombus americanorum F. ♂ ☿, s. and c. p., freq.; (2) Melissodes bimaculata Lep. ♀, c. p.; (3) M. obliqua Say ♀, c. p.

Trochilidæ: (4) Trochilus colubris L., s., two.

I have found the flowers in bloom from July 22nd to Oct. 15th.

Müller found it visited by one Macroglossa, three Bombus, one Apis, one Colletes, one Panurgus, three Eristalis.

ŒNOTHERA FRUTICOSA L.—This is a common plant, growing on prairies. The stem rises a few dm. and generally bears one, sometimes two or three, yellow flowers which expand 4 or 5 cm. Eight large versatile anthers supply pollen, which is an attractive character of the flower. The stigma surpasses the anthers so that self-pollination is impossible without insect aid. As a rule, the stigma is inclined to the lower side in such a position that it readily strikes the ventral surface of a bumble-bee settling upon the flower. If insects come with pollen, they may effect cross-pollination, otherwise they may effect self-pollination. When two or more flowers are expanded at the same time cross-pollination between flowers of the same plant may occur. In the usual case in which the stem exposes only one open flower at a time cross-pollination between distinct plants is the rule.

The tube measures 14–20 mm., so that it can only be drained by the largest bees, but shorter-tongued bees are sometimes able to reach a little of the nectar which rises in the tube.

Besides the long-tongued insects which visit the flower for nectar, there are many species, especially Andrenidae and Syrphidae, which come only for pollen. Accordingly the flower must be regarded as adapted to both sets of insects.

The flowers bloom from May 24th to June 29th. On 7 days, between May 28th and June 19th, the following list was observed:

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[3] See Müller: Fertilization of Flowers, 246.

Hymenoptera—*Apidæ:* (1) Bombus americanorum F. ♀, s. and c. p., ab.; (2) Synhalonia speciosa Cr. ♀, s. and c. p.; (3) Ceratina dupla Say ♀, c. p.; (4) Megachile brevis Say ♂♀, s.; (5) M. montivaga Cr. ♂♀, s. and c. p., ab.; (6) Alcidamea producta Cr. ♀, c. p.; *Andrenidæ:* (7) Agapostemon nigricornis F. ♀, c. p., ab.; (8) Augochlora pura Say ♀, c. p., freq.; (9) Halictus pectoralis Sm. ♀, c. p.; (10) H. parallelus Say ♀, c. p.; (11) H. lerouxii Lep. ♀, c. p.; (12) H. ligatus Say ♀, c. p.; (13) H. fasciatus Nyl. ♀, c. p.; (14) H. albipennis Rob. ♀, c. p.; (15) H. confusus Sm. ♀, c. p.

Diptera—*Syrphidæ:* (16) Syrphus americanus Wd., f. p.; (17) Sphaerophoria cylindrica Say, f. p.; (18) Eristalis dimidiatus Wd., f. p.; (19) E. latifrons Lw., f. p.; (20) Tropidia mamillata Lw., f. p.; *Tachinidæ:* (21) Cistogaster pallasii Twns., f. p.

Lepidoptera—*Rhopalocera:* (22) Pieris protodice B.-L.; (23) Pamphila peckius Kby.; (24) P. cernes B.-L.—all s.

Coleoptera—*Chrysomelidæ:* (25) Diabrotica 12-punctata Oliv., f. p.; *Curculionidæ:* (26) Centrinus scutellum album Say, f. p., ab.

GAURA BIENNIS L.[4]—This common species was observed in bloom from August 4th to October 24th. The stems grow one or two metres high, bear numerous flowers, and are often collected in large patches.

The flowers are white. The four petals are all turned to the upper side of the flower, and the stamens, which are directed horizontally, afford a landing place to the visiting insects. The stigma is in advance of the anthers and touches the bee before them. The calyx tube is about 10 mm. long. The flowers are adapted to long-tongued bees, but on account of the exposure of the anthers are also visited for pollen by other insects. The list was observed on 5 days, between Aug. 23d and Sept. 10th.

Hymenoptera—*Apidæ:* (1) Apis mellifica L. ☿, c. p.; (2) Bombus americanorum F. ☿, s. and c. p., ab.; (3) B. virginicus Oliv. ☿, c. p.; (4) Melissodes bimaculata Lep. ♀, s. and c. p.; *Andrenidæ:* (5) Halictus confusus Sm. ♀, c. p.

Diptera—*Syrphidæ:* (6) Syrphus americanus Wd., f. p.

CIRCÆA LUTETIANA L.—The flower is described and figured by Müller in the Fertilization of Flowers, 265. Müller saw the flowers visited by: *Syrphidæ:* (1) Baccha elongata F.; (2) Ascia podagrica F.; (3) Melanostoma mellina L.; *Muscidæ:* (4) Musca domestica L.; (5) Anthomyia sp.

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[4] See Sprengel; 223, Pl. XIII, 12, 14, 15. See G. Lindheimeri, Goodale & Sprague: Wild flowers, Pl. XXIII.

July 2nd, 4th and 10th I saw the flowers visited by:

Hymenoptera—*Andrenidæ* (1) Augochlora pura Say ♀, s. and c. p., freq.; (2) Halictus 4-maculatus Rob. ♂ ♀, s. and c. p., ab.; (3) H. confusus Sm. ♀, s. and c. p.; (4) H. pectinatus Rob. ♀, c. p.; *Chalcididæ:* (5) Spilochalcis debilis Say, s.

Diptera—*Bombylidæ:* (6) sp.; (7) Hemipenthes sinuosa Wd., f. p.; *Syrphidæ:* (8) Allograpta obliqua Say; (9) Mesograpta marginata Say; (10) M. geminata Say—all sucking.

MOLLUGO VERTICILLATA L.[5]—"An immigrant from farther south."—The plants are much branched, the branches lying flat on the ground and bearing small, white flowers, which are numerous but not enough to form conspicuous clusters.

The flowers are erect, expand horizontally and measure about 4 mm. across. The three anthers rise to the level of the three stigmas and alternate with them.

In case of insect visits, cross-pollination between flowers of the same or of distinct plants may readily occur. In case insects fail, spontaneous self-pollination may take place by the anthers coming in contact with the stigmas.

Although the flowers are very inconspicuous, they are attractive to numerous small insects, mainly *Halictus*, on account of their easily accessible nectar.

I have found the plant in bloom from July 1st to Oct. 12th. On three days, July 16th, and Aug. 11th and 21st, the following list of visitors was observed:

Hymenoptera—*Andrenidæ:* (1) Halictus fasciatus Nyl. ♂, s.; (2) H. pilosus Sm. ♂, s.; (3) H. confusus Sm. ♂ ♀, s. and c. p. freq.; (4) H. tegularis Rob. ♂ ♀, s.; (5) H. stultus Cr. ♀, s. and c. p. freq.; *Philanthidæ:* (6) Cerceris finitima Cr., s., freq.

Diptera—*Conopidæ:* (7) Zodion nanellum Lw.; *Syrphidæ:* (8) Paragus tibialis Fll.; (9) Pipiza pulchella Will.; (10) Mesograpta marginata Say; *Sarcophagidæ:* (11) Sarcophaga sp.; *Muscidæ:* (12) Lucilia cornicina F.—all sucking.

Coleopetra—*Malachidæ:* (13) Collops 4-maculatus F., s.

SAMBUCUS CANADENSIS L.—The stems grow three or four meters high, and are commonly collected in clumps, which at blooming time are fairly white with the large flat-topped cymes. The flowers expand 4 or 5 mm. They are homogamous. The stamens are so strongly divergent that spontaneous self-pollination is impossible. Nectar is wanting, the object of insect visits being the pollen. The plant is common and was observed in bloom from June 15th to July 25th. June 17th, 23d and 24th, the following visitors were noted:

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[5] On this plant see Meehan; Torrey Bulletin, XIV, 218.

Hymenoptera—*Apidæ:* (1) Apis mellifica L. ☿, freq., (2) Ceratina dupla Say ♀; *Andrenidæ:* (3) Halictus zephyrus Sm. ♀, ab.; (4) H. confusus Sm. ♀, ab.; (5) H. stultus Cr. ♀, ab.—all collecting pollen.

Diptera—*Bombylidæ:* (6) sp.; (7) Hemipenthes sinuosa Wd.; *Syrphidæ:* (8) Chrysogaster nitida Wd., ab.; (9) Syrphus ribesii L., freq.; (10) Allograpta obliqua Say, freq.; (11) Mesograpta marginata Say; (12) Eristalis dimidiatus Wd.; *Muscidæ:* (13) Lucilia cornicina F.; *Anthomyidæ:* (14, 15) Chortophila spp.—all feeding on pollen.

Coleoptera—*Dermestidæ:* (16) Attagenus piceus Oliv.; *Malachidæ:* (17) Anthocomus erichsoni Lec.; *Cerambycidæ:* (18) Euderces picipes F.; *Mordellidæ:* (19) Pentaria trifasciata Melsh.—all feeding on pollen.

HOUSTONIA PURPUREA L., VAR. CALYCOSA Gr.—This common plant grows in tufts or clusters which are rendered quite conspicuous by the abundant white flowers, the stems rising about 2 dm.

The corolla is funnel-form, measuring about 8 mm. in length, its border also expanding about 8 mm. The tube is about 7 mm. Below it is narrowed for about 4 mm. Small bees can insert their heads as far as 3 mm., when they need a proboscis 4 mm. to drain the sweets. The narrow part of the tube is obstructed in both forms by abundant hairs, in the long-styled form by the anthers and in the short-styled form by the stigma. The anthers of the short-styled form are in the angles of the mouth of the tube, the stigma of the long-styled form being more strongly exserted.

The anthers of the long-styled form apply their pollen to the proboscides of the visitors. The anthers of the short-styled form dust their pollen indefinitely upon all parts of the insects. Accordingly the long-styled form has a larger stigma.

The flowers are adapted to small bees, like *Ceratina*, *Calliopsis* and *Halictus*, but are also visited by flies, beetles and butterflies. Butterflies, however, are only adapted to pollinate the short-styled form, since they can suck this form without touching the anthers. A monopoly of the flowers by them would probably result in a functional diœcism, characterized by long-styled staminate and short-styled pistillate flowers.

The plant blooms from May 19th to June 30th. The list was observed on 6 days, between May 25th and June 12th.

Hymenoptera—*Apidæ:* (1) Apis mellifica L. ☿, s.; (2) Synhalonia honesta Cr. ♂, s.; (3) Ceratina dupla Say ♂♀, s. and c. p., ab.; (4) Heriades carinatum Cr. ♂ s.; (5) Calliopsis andreniformis Sm. ♂♀, s. and c. p., ab.; *Andrenidæ:* (6) Augochlora pura Say ♀, s. and c. p.; (7) Halictus ligatus Say, ♀, s.; (8) H. pilosus Sm. ♀, s. and c. p.; (9) H. confusus Sm. ♀, s. and c. p.; (10) H. albipennis Rob. ♀, s. and c. p.

Diptera—*Syrphidæ:* (11) Paragus bicolor F., s.; (12) P. tibialis Fll., s.; (13) Mesograpta marginata Say, s.; (14) Sphaerophoria cylindrica Say, s. and f. p., ab.; (15) Syritta pipiens L., s.

Lepidoptera—*Rhopalocera:* (16) Pieris protodice B.-L.; (17) Chryophanus thoe B.-L.; (18) Ancyloxypha numitor F., ab.; (19) Pholisora catullus F. —all sucking.

Coleoptera—*Scarabæidæ:* (20) Trichius piger F., s., ab.; *Curculionidæ:* (21) Centrinus scutellum-album Say, s.; (22) Stethobaris sp., s.

Carlinville, Ill.

Botanical papers read before Section F, A. A. A. S., Rochester meeting.

N. L. Britton: "*Notes on Ranunculus repens and its eastern North American allies.*"—Attention was called to the group relationship that evidently exists between the European R. repens and such American species as *R. hispidus* Mx., *R. fascicularis* Muhl., *R. septentrionalis* Poir., *R. palustris* Ell. (a somewhat doubtful southern species), and the British Columbian *R. Macounii* Britton. Illustrated by specimens.

N. L. Britton: "*Notes on a monograph of the North American species of Lespedeza.*"—The author believes that it would facilitate the study of these species to recognize a greater number of species than heretofore, instead of considering some of them forms. Illustrated by numerous specimens.

W. W. Rowlee: "*The root-system of Mikania scandens.*"—Mikania develops a great number of roots under water which never reach the soil. The greatest development of these is